IMPACT: Journal of Research in Applied, Natural and Social Sciences (IMPACT: JRANSS)
ISSN(E): Applied; ISSN(P): Applied
Vol. 1, Issue 1, Jun 2015, 15-26

AN EVIDENCED-BASED STUDY: MEASURING THE EFFECT OF IMPLEMENTING AN INFECTION CONTROL PROGRAM ON HEALTH CARE PROVIDERS' COMPLIANCE TO INFECTION CONTROL MEASURES

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ABSTRACT

In Palestinian, 10% of deaths among children under the age of five are related to infections. Practice of infection prevention and control reduces the number of hospital-acquired infections. The purposes of this study were to explore health care team perceptions of causes of hospital-acquired infections and to develop, implement and measure the impact of infection prevention program in the ICU of a specialty pediatric hospital in Gaza Strip.

A quasi experimental with pretest-posttest design was used. All nurses and physicians were included in this study. Five dimensions were measured and investigated pre and post-intervention. An infection control educational program was designed and implemented.

After implementing the staff-developed program, the five dimensions were improved: using sharp box increased from 46.6% to 90%, doing gloves and scrubbing improved from 53.3% to 55%, frequency of hand washing increased from 47.2% to 79.3%, awareness of Palestinian protocol of infection prevention increased from 27.5 to 80% and positive swabs cultures decreased from 56% to 34.6%.

The study recommends rebuilding an the infection control committee, motivating and encouraging work team to apply control infection measures through training and continuous education, providing the necessary medical supplies. These are besides continuous monitoring and follow up from the administration.

KEYWORDS: Infection Control, Infection Control Standards, Hospital-Acquired Disease, Gaza, Palestine

INTRODUCTION

Children are a vulnerable group that needs more care and precaution during hospitalization than others. Their immune system is not well developed yet as that of the adults. Therefore, they are at higher risk to get infection than others. Many of pediatric morbidities and mortalities are due to infections and infectious diseases. In Palestine, about 10% of deaths among children under the age of five are related to infections and infectious diseases (Palestinian Health Information Center, 2011).

Integrated health management of childhood aims to reduce children's mortality and morbidity and improve healthy growth and development. This requires a well-organized health care system with high quality of care at all levels, including providing good health services and healthy environment (World Health Organization, 2010c).

Hospital acquired infections (HAI) are those infections acquired by patients while receiving care in hospitals or other health care facilities. HAI are not present at the time of admission (Scott, 2009). Infectious pathogens are transmitted from one person to another through direct or indirect contact. They are mostly caused by Candida albicans, Escherichia coli, hepatitis viruses, herpes zoster virus, pseudomonas and staphylococcus (Anderson & Anderson, 1995). These infections, often caused by multi-resistant pathogens, take a heavy toll on patients, their families, and health care system by causing illness, prolonged hospital stay, potential disability, excessive costs, and sometimes death (Allegranzi & Pittet, 2008).

About 10% of in-patients in developed countries sustain HAI during their hospital stay and the rate increases to 25% in developing countries (Bates, Larizgoitia, Prasopa-Plaizier, & Jha, 2009). The rate is much higher in intensive care units (ICU). About 30% of patients admitted ICU in high-income-countries develop HAI. The rate is 2-3 folds higher in low and middle income countries. The rates of HAI among newborn are much higher in developing countries as it can be up to 3-20 times that in high income countries (World Health Organization, n.d.). According to a report of the World Health Organization, the prevalence of neonatal care-associated infections was 14% in the United States, 7-14% in Europe, and 30% in Brazil and about 4384 children die every day due to HAI (World Health Organization, 2005).

According to Samuel et al. (2010), the best clinical care in the world can be worthless if patients pick up other infections while they are in hospital. Regardless of where the infection originates, it is surely the first duty of every member of staff in a hospital to do everything they can to make sure their patients are cared for and to improve their health, as quickly as possible and keep them free from HAI. This is consistent with the Hippocratic Oath related to “Do no harm”.

The purposes of this study were to explore health care team (nurses and physicians) perceptions of causes of HAI and to develop, implement and measure the impact of infection prevention program in the ICU of a specialty pediatric hospital in Gaza Strip.

BACKGROUND

Hospital acquired infections are a major international problem. Globally, it is estimated that 10% of all patients admitted to hospitals acquire HAI (The Research Committee of the Society of Healthcare Epidemiology of America, 2010). HAIs not only increase morbidity and mortality in patients but also increase economic burden on health care and deplete available limited resources (Rattinger et al., 2013).The incidence and costs related to HAIs vary from one country to another. For example, HAIs are one of the ten leading causes of death in the United States (US) and they account for approximately 1.7 million infections and cause about 99,000 deaths each year. The total costs related to HAIs in the US is estimated to be around $28 to $33 billion each year (Scott, 2009). The incidence rate of HAIs in Europe is estimated to be around 7.1 per 100 patients. The cost incurred by the British National Health Service due to HAIs is around £1000 million annually (Kelsey, 2000).

In Canada, more than 220,000 HAI cases are reported annually and related mortality is about 8,500 to 12,000 cases per year. The direct costs of HAI in Canada are estimated to be $1 billion annually (Canadian Union of Public Employees, 2014). In other countries such as Thailand, costs related to HAI were about 10% of annual budgets of Thai hospitals. In Mexico, these costs represent 70% of the entire budget of the ministry of health (World Health Organization, 2005).

HAIs rates range from 1% in Europe and America to more than 40% in some parts of Asia, Latin America and Sub-Saharan Africa (Lynch, et al., 1998). The most frequent HAI occurring in developing countries are surgical site infections (SSI), urinary tract infections and lower respiratory tract infections such as pneumonia (Emori & Gaynes, 1993).The burden of HAI is already substantial in developed countries, where it affects 5% to 15% of hospitalized patients in regular wards and up to 37% of patients in intensive care units (World Health Organization, 2009).

Infection prevention and control (IPC) measures are integral parts of pediatric practice. All employees should learn about the routes of microorganism transmission and techniques used to prevent transmission of infectious agents. Policies for infection control and prevention should be written, made available, updated annually and enforced. Published reports discus methods of preventing HAIs and estimate that at least one-third of HAI could be prevented using current WHO recommendations regarding infection control. More recent advances using “bundled” best practices have shown that hospitals can eliminate some infections for extended periods of time (Berenholtz et al., 2004; Harbarth, et al., 2003).

Hospital infection control with surveillance was first introduced in the Republic of Korea with the appointment of a full-time infection control nurse, an infection control physician, and the organization of an infection control unit at the Seoul National University Hospital in 1991 (Oh, Yi, & Choe, 2005). According to Scheckler et al. (1998), the ultimate goal of surveillance in hospital infection control programs is to protect patients, healthcare workers, and others from HAI in a cost-effective manner.

Each health institution, including Palestinian health institutions, should use specific infection control and prevention activities or protocols (Palestinian of Ministry Health, 2004). Employees working in pediatric hospitals are supposed to take precautions to protect both clients and staff who are involved in direct contact with infectious materials during their practice (Palestinian Health Information Center, 2011).Infection prevention standard precautions represent a system of barrier precautions to be used by all personnel when they come in contact with any patient regardless of the patient’s diagnosis. These precautions are slightly different according to the country policies and protocols. The precautions are the “standards of care” but basically their components include washing hands, wearing gloves, using physical barriers, using safe work practices, process of instrument re-cleaning and protect workers. This is besides considering every person as potentially infectious (World Health Organization, 2009).

In a study conducted by Gravel et al. (2007), they found that the international prevalence of HAIs among pediatrics was comparable with the rates reported about adult patients. According to Gravel et al, the HAI rate was around 8% among pediatrics. The most common reported HAIs among pediatrics were bloodstream infections (Advani, et al., 2011; et al., 2013).

Infection control measures and standard precautions are a top priority in health care and must be integrated fully into the processes of quality improvement of care at any health care system (Eggimann & Pittet, 2001; Moore, 2001). Therefore, it is important to practice standard precautions for infection control and to develop interventions and prevention strategies to control the incidence of HAIs.

METHODOLOGY

Study Design

The study was conducted in three phases. In the first phase of the study, the researchers used semi-structured,

private face-to-face interviews with health care providers who have close contact with patients (nurses and doctors) to investigate their perception related to infection control in all departments of a specialty pediatric hospital in Gaza Strip.

After analyzing data obtained from health care providers in the first phase of the study, a questionnaire was developed to further assess their commitment to practice of infection control measures. The questionnaire consisted of 17 items that needed a yes/no answer. Examples of the items are "do you wash your hands whenever you enter or leave the department," "is there a sharp box available at each room" and "do you know that there is a Palestinian infection Protocol." Then, an intervention program to improve infection control practice among participants was developed and implemented over a period of two months. In the last phase, the researchers measured the effects of the interventions by evaluating the incidence of HAI in the four months following the implementation of the interventions.

Study Sample

All health care providers who are working on full-time bases and involved in direct contact with patients (nurses and doctors) in all departments of the hospital were included in this study. Other staff members who are not involved in direct contact with patients were excluded.

The setting for the study was the only hospital specialized to provide tertiary care for children in Gaza Strip. The specialty pediatric hospital is considered a referral medical center for children under the age of 12 who need tertiary medical services in Gaza Strip. It provides inpatient and outpatient tertiary care that cover several spectra of health care services such as cardiac, renal/dialysis, neurology, endocrine, neurology, respiratory and oncology (Palestinian Health Information Center, 2011).

Outcome Measures

The three outcome measures explored pre- and post-intervention were (1) percentage of positive swab cultures taken from all departments before and after the intervention, (2) percentage of medical staff who applied infection control measures during contact with patients, and (3) percentage of knowledge among medical staff about Palestinian protocol of infection control.

Data Collection

Data were collected through:

- Collecting swab cultures from the equipment in all departments such as patients' beds, emergency trolleys, medication trolleys, ambo bags during a period of eight weeks. 25 swab cultures were taken from patients' beds, and 10 swab cultures were taken from medication and emergency trolleys.
- Direct observation (using pre-prepared checklists) for all medical team during performing their duties.
- Face to face interview with medical team to complete a questionnaire concerning methods of spreading infection and how to prevent or minimize it.

Ethical Consideration

Prior to involvement of this study, the approval of Helsinki Committee for Research and Ethics in Gaza was obtained along with the approval of Ministry of Health and the director of the hospital. The consent of participants was

obtained after discussing the purpose of the study to them and answering any question they had. Confidentiality and anonymity of participants were ensured during this study.

RESULTS

Pre Intervention Tests and Results

Researchers met all nurses and doctors who were involved in direct contact with patients and asked them to complete the questionnaire. This was in addition to observing them during performing their duties for a period of two months. Researchers developed and used two chick lists to evaluate the level of adherence of participants to standards of infection control practice. Results (table 1) of pre-test showed low adherence rate of medical staff to standards of infection control and relatively high percentage of contaminated swabs. During the pre-intervention time, 35 swabs were taken from different equipment such as beds and medication and emergency trolleys. The results for swab culture were as follows; 14 out of 25 (56%) swab cultures from patients' beds were positive and two out of 10 sample (20%) swab cultures from emergency and medication trolleys were positive. Furthermore, from observing the staff during the pre-intervention time (table 1), the rates of using sharp box, donning gloves and scrubbing, practicing hand washing were very low. Besides that, the great majority of staff were not aware of the Palestinian infection control protocol.

Table 1: Results of Pre Intervention Test

Skill	Using Sharp Box	Doing Scrubbing	Hand Washing	Aware of Protocol	Swab Cultures
Positive ratio	46.6%	53.3%	47.2%	27.5%	56%.

Swab cultures from supplies (beds, emergency and medication trolleys) are very important because beds and medicationt rolleys are in direct contact with patients, which make them a good media for growth of microorganisms that can be transmitted to other patients. Positive swabs cultures indicate that there is a contamination by pathogens that have the potential to cause infection. These result require high-quality intervention to decrease the number of positive results and therefore to eliminate infection.

Infection control protocol knowledge deficit needs some interventions from the administration to improve staff knowledge about infection control. Because health care providers are in direct contact with patients, they are considered the main source for transmitting HAI. Therefore, it is very important that they adhere to the standard precautions for infection control such as performing frequent hand washing and disposing sharp equipment in the sharp box. Performing these procedures is vital to enhance clean work environment and to curtail the spread of pathogens.

Based upon these results, the researchers, the health care providers in the department, and the infection control committee in the hospital, brainstormed to identify possible causes of HAI in the departments and to identify possible preventive measures that could be used to decrease the incidence of HAI in these departments. The outcome of this brainstorming session was identifying seven possible factors that contributed to the occurrence of HAI in the department. These factors were: (1) inadequate knowledge of infection control; (2) inadequate skills in performing some procedures and absence of training about infection control; (3) lack of leadership, supervision, and follow up; (4) lack of infection control protective equipment and materials; (5) shortage of antiseptic solutions; (6) shortage of nurses and high workload on all staff; and (7) misunderstandings of some concepts about aseptic technique.

Intervention

Preventing infection means to observe and watch habits, lifestyles, and surroundings and then assessing for those issues that may promote infection. By identifying these issues in the infection chain, some steps can be taken to eliminate infection by cutting that chain at the easiest possible point (Bates et al., 2009). On the light of the seven factors identified as contributing factors to the occurrence of HAIs, the researchers designed a plan for high-quality intervention. The plan included providing infection prevention supplies and equipment, and developing and educational and training program about infection control including proper techniques for hand washing scrubbing and disinfection.

Providing Infection Prevention Supplies and Equipment

Personal protective equipment (PPE) articles or garments that act as barriers between infectious materials and the skin, mouth, nose, or eyes (mucous membranes). When used properly, PPE can prevent the spread of infection from one person to another. Examples of PPE include: disposable gloves, gowns, laboratory coats, protective face shields, resuscitation masks or shields, and mouth pieces. Any equipment necessary to prevent exposure to blood or other potentially infectious material are considered PPE. Effective personal protective equipment must not allow potentially infectious materials to pass through or reach to skin, eyes, mouth, or clothes under normal conditions of use. General work clothes, such as uniforms, pants, shirts, or blouses, which are not intended to function as a protective barrier against hazards, are not considered to be PPE (Daugherty et al., 2009; Occupational Safety & Health Administration, 2012). All needed PPE were provided to the department during the intervention phase. In addition to PPE, the research team provided the department with alcohol-based hand rub in order to minimize the number pathogens with maximum efficacy and speed, which will minimize the chance for spread of infection.

Education and Training about Infection Control

Education is an important part in the intervention process especially that only about one third of health care providers included in this study knew that there is a Palestinian IPC protocol. Ironically, there was not any copy of protocol available at the hospital. Therefore, the researchers decided to implement an intervention program for physicians and nurses to increase their level of awareness about the protocol of infection control and the aseptic measures. The intervention program was prepared with the cooperation of the infection control committee at the hospital. Along with the program, the researchers distributed pamphlets to the health care providers. The pamphlets included information related to demonstration of the proper techniques of hand washing, donning sterile gloves, use of sharp box, and other measures to prevent cross infection inside the departments. The intervention program included educating and training involved nurses and physicians about the basics of infection control and prevention, demonstrating and practicing infection control procedures, effective and efficient use of available scarce resources, developing and enforcing an infection control policy.

Hand Washing

Hand washing is the single most effective measure of preventing infections, and it is a major component of the standard precautions. The use of antiseptic solutions will help to kill pathogens and inhibit its transmission from staff to patients. Antiseptic hand washing reduces the number of micro-organisms on intact skin to an initial baseline level after adequate washing, rinsing and drying. It is a broad spectrum, fast acting, and persistent (Boyce &Pittet, 2002).Alcohol-Based Hand Rub(ABHR) is rarely used in Gaza hospitals, since there is an extreme shortage of the basic materials used in

hand rubbing which comes mainly from donations.

Therefore, through a lecture, the research team explained the importance of using standard precautions for infection control and demonstrated the proper technique for some procedures such as hand washing and donning sterile gloves. Then each participant was allowed to demonstrate hand washing. When needed, feedback was given. Posters that were developed by the WHO were posted in several locations in the departments to remind staff about proper technique of hand washing procedure and the importance of using infection control measures.

Scrubbing and Disinfection

Good scrubbing and disinfecting all non-disposable equipment during hospitalization and after discharge of the patients lead to minimizing the number of pathogens and reducing the incidence for HAI (Rutala, et al., 2008; Sehulster et al., 2003). Therefore, the lectures and demonstration sessions included information about the importance of scrubbing and disinfection and the equipment and solutions used for disinfection. At the end of the session, demonstration was done for proper disinfection of some equipment.

Furthermore, the research team provided the department with three copies of the Palestinian infection protocol. The contents of the protocol were explained to participants. At the end of the session, research team and members of the infection control committee at the hospital listened to the participants' notes and answered their questions.

Post-Intervention Results

The same outcomes measures used in the pretest were used to evaluate the effectiveness of the intervention program. The post-intervention results are summarized in table two along with pre-intervention results. As noticed, the results showed that there were (1) an increase in the knowledge level about infection control protocol from 27.5% to 80%; (2) an increase in performance of hand washing from 47.2% to 79.3%, (3) an increase in the use of sharp box and awareness about the risk of sharp instrument on patients and the team work from 46.6% to 90%; and (4) a decrease in the percentage of positive swab cultures from 56% to 34.6%. These results indicated that the interventions provided by the research team were effective.

Table 2: Positive Result of Pre and Post-Intervention Test

Skills	Using Sharp Box	Doing Scrubbing.	Hand Washing	Aware of Protocol	Swab Cultures
Positive ratio (pre-test)	46.6%	53.3%	47.2%	27.5%	56%.
Positive ratio (post-test)	90%	55%	79.3%	80%	34.6%

DISCUSSIONS

The results of this study revealed that the intervention program had positive outcome in the light of outcome measures used to determine its effectiveness. Most of the activities of the intervention program were conducted with the cooperation of the infection control committee within the hospital. Part of the educational program was to raise health workers' awareness about the importance and the need for personal hand hygiene. Involvement of the researchers, infection control committee at the hospital, and the hospital administration increased compliance with the instructions and adherence of staff to infection control measures. Providing the department with the needed medical supplies and equipment was a vital factor that contributed to the success of this project.

The results of this study are compatible with the latest recommendations of the Agency for Healthcare Research and Quality to implement a comprehensive unit-based safety program (CUSP), which emphasizes the use of effective communication, team work, and leadership to create a culture of safety (Clancy, 2010).

In the CUSP, after educating staff about the science of safety, they completed an assessment of patient safety culture. Hospital administration and supervisors were considered partners with the unit staff. They worked together to improve communication and to educate staff about safety measures. Staff learned from unit failures and used effective evidence-based safety tools, such as checklists, to improve teamwork, communication, and work systems (Dingley, et al., 2008).

The results of this study are similar to the findings of Brilli et al. (2013) and Luby et al. (2004). Brilli et al. (2013) implemented a comprehensive educational patient safety program which lead to significant reduction in incidence of HAI, associated costs, and hospital mortality. Luby et al. (2004) reported the results of a trial study that aimed to evaluate the impact of hand hygiene promotion on most common childhood infectious diseases for the low income population living in the Squatter settlements of Karachi, Pakistan. The use of soap and adoption of education have greatly decreased impetigo by 34%, diarrhea by 53% and pneumonia by 50%. Disease duration was shorter, thus probably reducing the duration of infectivity for household contacts. Children were 56% less likely to consult a health care practitioner for diarrhea and 26% less likely to be hospitalized (Luby et al., 2004).Other studies revealed a significant effect of enforcing the practice of basics of infection control measures such as the use of universal precautions and gloving during patient care (Gravel et al., 2007; Sandora, 2010; Yin et al., 2013).

Gaza strip suffers from extreme shortages of medical supplies including drugs, equipment, and medical disposables in the last nine years (World Health Organization, 2010a, 2010b) which negatively affect the quality of provided health care services (Moore, 2001) including those related to infection control. The research team was able to provide the hospital with needed supplies and equipment during the study period, but it is doubtful that this can be the case in the future. The political and financial crisis and the limited resources in Gaza Strip affected the ability of the ministry of health to provide appropriate resources and pay salaries for all employees. Such complicated situation presents serious challenges to continue effective infection control and prevention at the health sector in Gaza Strip.

CONCLUSIONS

The results of this study proved that staff education and involvement were effective tools to minimize HAIs as there was a significant improvement in staff's practice of infection control practices after implementing the intervention program at the specialty pediatric hospital which will be inflected in a decrease in the incidence of HAI. Unfortunately, because of the limited funding for the study and limited resources, the research team could not increase the period of the intervention program, which could result in more reliable results. Therefore, it is recommended that health care policy makers enforce an infection control policy that goes with the limited resources of the health care sectors. In fact, enforcing such policies will result in decreasing the number of HAIs and length of hospitalization which will be reflected in the total cost of patients care. The administration of the hospital is recommended to follow up and implement further education about infection control to the rest of the staff at the hospital.

ACKNOWLEDGEMENTS

The authors would like to thank all participants of this study for their cooperation to produce this research study. We are also very grateful for the infection control committee and the administration of the hospital for their cooperation.

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